Claim 1-10 are in the application.

Reconsideration and withdrawal of the rejection of claims 1-10 under 35 U.S.C. 112 as being indefinite is respectfully requested. The claims have been revised to provide proper antecedence for the terms in question.

Reconsideration and withdrawal of the rejection of claims 1 through 10 under 35 USC 112, second paragraph, as being incomplete for omitting essential elements is respectfully requested. The examiner points out that the omitted elements are a description of the physical interconnection, not the function, of the circuit components; the physical connection of the final circuit stage with the secondary stage and other components; and the physical connection of the final stage.

Applicant respectfully submits that the physical connection between the individual components of the circuit of Fig. 1 is provided in the form of electrical wiring. A different kind of physical connection is not possible. This is apparent from the employed components inductive store 1, the piezotranslator 2, switches 3 and 4, the diodes 5 and 6, and voltage sources 7, 8. Also, the specification describes that the switches 3 and 4 can be embodied as an arrangement of a MOSFET 9 and corresponding

diodes 10 and 11 wherein these components based on their structure must be hard-wired. This would concern also the aforementioned other components. The term `wired' and `wiring' can be found in the specification on page 11, line 30. The claims have been amended accordingly.

Reconsideration and withdrawal of the rejection of claims 1-10 under 35 U.S.C. 103(a) as being unpatentable over U.S. patent 4,947,074 to Suzuki in view of U.S. patent 4,973,876 to Roberts and further in view of U.S. patent 5,017,010 to Mamin et al. is respectfully requested.

According to present claim 1, the clocked switches are arranged in a half-bridge and are provided in the form of MOS transistors, wherein an external diode is series-connected to the switching path. This series connection is bridged by a commutating diode which is poled opposite to the external diode. Another principal idea of the present invention is expressed in claim 6 and resides in a circuit configuration for dynamic control of piezotranslators (ceramic solid-state actuators) with energy recovery. The energy recovery is realized by a single inductive intermediate store series-connected with the piezotranslator. According to the invention, the clocked switches are positioned in a half-bridge wherein for obtaining the predetermined linear voltage course at the piezotranslator, a

current control with a current sensor controls the clocked switches of the half-bridge with high cycle or switching frequency. Moreover, a position control is superimposed on the current control.

Figs. 1 through 4 of Suzuki do not show half-bridge arrangements in the sense of the present intention. This is apparent when comparing Fig. 1 of the present invention with Figs. 1 through 4 of Suzuki. A half-bridge arrangement in the sense of the invention is provided when the elements inductive store 1 and piezotranslator 2 connected in series are arranged in separate circuits each having a voltage source (i.e., a total of two voltage sources are provided). In Fig. 1 of the invention, the voltage sources 7, 8 are provided; they each carry the voltage UB/2. Each one of the two circuits is provided with a switch (3, 4). The switches 3, 4 open and close alternatingly.

According to the invention, and as illustrated in Fig. 1, the switches 3 and 4 can be expediently replaced by the MOSFET arrangement of Fig. 2. The switches 3 and 4 in the arrangement according to Fig. 1 are connected in series in regard to the arrangement of the inductive store 1 and the piezotranslator 2. The discussed features describes the half-bridge circuit according to the invention precisely.

In contrast to this, Suzuki does not show a half-bridge arrangement. Fig. 1 of Suzuki shows that the voltage source 1 with the piezoelectric element 2 forms a single circuit which is closed via ground. Accordingly, an important feature of a half-bridge circuit is not provided. The coil 5 is parallel-connected to the piezoelectric element 2. Moreover, the switches 6, 7 are also connected parallel to the piezoelectric element 2 and activate and deactivate the coil 5. This configuration therefore does not show two separate circuits which open and close independently from one another as is the case in the present invention. This is also true in regard to the configuration illustrated in Fig. 4 of Suzuki. In this configuration the coil 53 is serially connected to the piezoelectric element 2; but in this embodiment the voltage source 1 supplies only a single circuit with voltage. This embodiment therefore also does not show a half-bridge arrangement and does not relate to the subject matter of the present invention as claimed.

Accordingly, the teaching of Suzuki cannot be combined with the teaching of Roberts in order to arrive at the present invention. Roberts shows in Fig. 2 a DC/AC converter 100 which comprises circuits of a MOSFET 114 and diodes 116 and 118 which are comparable with the circuit of Fig. 2 of the present intention. The important feature of the present invention, however, is the half-bridge arrangement which is obviously not

disclosed in or suggested by Suzuki. Even though a person skilled in the art can derive from Roberts the aforementioned circuit of MOSFET 114 and diodes 118, 116, a person skilled in the art cannot find any incentive to combine Roberts and Suzuki to arrive at the present invention - Suzuki does not disclose the important feature of a half-bridge arrangement.

The cited prior art Mamin shows a position sensor and a method correlated therewith. This disclosure has no relevance in regard to position control of a piezoelectric translator. Specifically, a method for detecting highly sensitive position changes optically is described in Mamin which, in particular, is suitable for position determination of cantilevers in the context of atomic force microscopy. A current sensor or an electromechanical sensor which is employed according to the present invention is not disclosed in this cited prior art reference. It is not apparent how the teaching of this prior art reference, i.e., a method specifically designed for atomic force microscopy cantilevers and the related device, can be used for position control of a piezoelectric element. Instead, a method is described which enables to position the cantilever 14 by means of an XYZ drive 25 wherein reflected light from a diode laser 13 is evaluated by means of a directional coupler 10 as a control signal. There is no teaching to be derived to employ such an arrangement as a position sensor for a piezoelectric element.

In summarizing the above, the combination of the cited prior art references Suzuki, Roberts, and Mamin does not make obvious the invention as claimed.

Therefore, in view of the foregoing, it is submitted that this application is now in condition for allowance and such allowance is respectfully solicited.

Any additional fees or charges required at this time in connection with the application may be charged to Patent and Trademark Office Deposit Account No. 11-1835.

Respectfully submitted,

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Encl.: amended claims 1, 3, 4, 6-8 (clean copies and marked-up version)

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on December 20, 2002.

By: _____ Date: December 20, 2002
Friedrich Kueffner

MARKED-UP VERSION OF CLAIM 1, 3, 4, 6-8

1. (Twice Amended) A wired circuit arrangement for the dynamic control of piezotranslators (2) with energy recovery by means of a single inductive intermediate store (1) which is ~~arranged~~ connected in series with the piezotranslators (2) as well as by clocked switches, wherein for achieving a predetermined linear voltage characteristic at the piezotranslator (2), ~~the~~ a secondary circuit is designed as a half-bridge consisting of the clocked switches (3, 4) ~~at whose~~ having an output, respectively, wherein the inductive intermediate store (1) is connected to the output of the clocked switches, respectively, and connected ~~arranged~~ in series with the piezotranslator (2), with the clocked switches (3, 4) connected to an upper supply voltage or a lower supply voltage and being externally controlled and operated at a high cycle or switching frequency in such a manner that the intermediate store is alternately connected with ~~an~~ the upper or lower supply voltage ((UB/2) at the most, with the series connection of piezotranslator (2) and inductive intermediate store (1) carrying a superimposed bridge direct current; wherein the clocked switches (3, 4) are formed as MOS transistors (9), with an external diode (10) being connected in series with the clearance between contacts, and this series connection being bridged by a commutating diode (11) which is oppositely poled to the diode (10).

3. (Twice Amended) The circuit arrangement according to claim 1, comprising a current sensor (12) connected to a first controller (13) and a final stage (18) connected to the first controller (13), wherein ~~a~~ the current sensor (12) for generating a control voltage which is proportional to the output current of the final stage (18) is connected ~~arranged~~ in the ~~secondary~~ circuit arrangement of the piezotranslator (2) for controlling the

circuit arrangement, with the control voltage being connected with a first input of the ~~a~~ first controller (13), wherein a second input of the first controller (13) is ~~applied at~~ connected to an output of a second controller (14), at whose two inputs a predetermined reference variable according to the physical position of the piezotranslator (2) and an actual value which is proportional to the output voltage of the final stage (18) are applied.

4. (Twice Amended) The circuit arrangement according to claim 3, wherein a third controller (19) is provided for a positioning control, having a ~~at whose~~ first input receiving the reference variable of the physical position of the piezotranslator (2) and ~~at whose~~ having a second input connected to a sensor (20) detecting a mechanical actual value ~~which is detected via a sensor (20) of the piezotranslator (2) are applied~~, with the output of the third controller (19) being connected with one of the inputs of the second controller (14).

6. (Amended) A wired circuit arrangement for the dynamic control of ceramic solid-state actuators in the form of piezotranslators with energy recovery by means of a single inductive intermediate store, which is ~~arranged~~ connected in series with the piezotranslator, as well as by clocked switches arranged in a half-bridge, wherein, for achieving a predetermined linear voltage characteristic at the piezotranslator, a current control comprising a current sensor connected to the clocked switches and controlling ~~controls~~ the clocked switches of the half-bridge at a high clock or switching frequency and wherein a position control is superimposed on the current control.

7. (Amended) The circuit arrangement according to claim 6, wherein the intermediate store is ~~arranged~~ connected in close proximity to the piezotranslator.

8. (Amended) The circuit arrangement according to claim 6, wherein, for controlling the arrangement, the current sensor is arranged in ~~the~~ a secondary circuit of the piezotranslator for determining a control voltage that is proportional to an output voltage of a final stage, wherein the current sensor (12) is connected to a first controller (13) and a final stage 18 is connected to the first controller (13), wherein the control voltage is supplied to a first input of ~~a~~ the first controller, wherein ~~the~~ a second input of the first controller is connected to an output of a second controller having two inputs supplied with a predetermined reference variable according to the physical position of the piezotranslator and with an actual value which is proportional to the output voltage of the final stage.